Gas Journal

VOL. 304 112th YEAR LONDON, OCTOBER 19, 1960 No. 5068 PRICE 1/6

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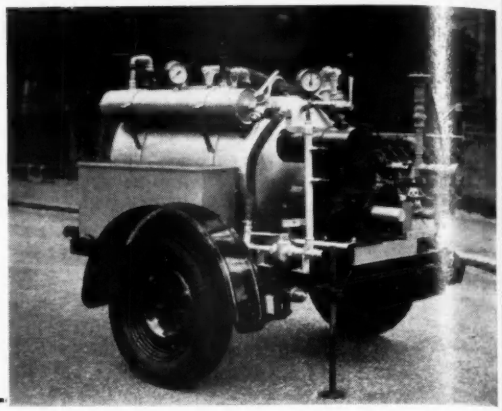
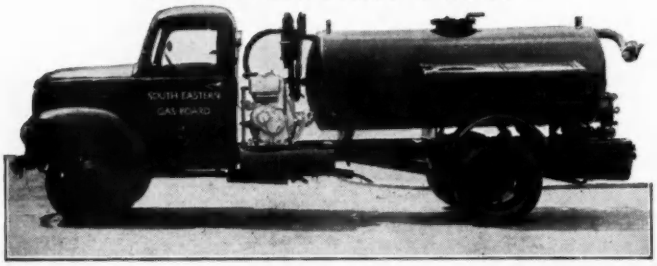


SYPHON EMPTYING OUTFIT



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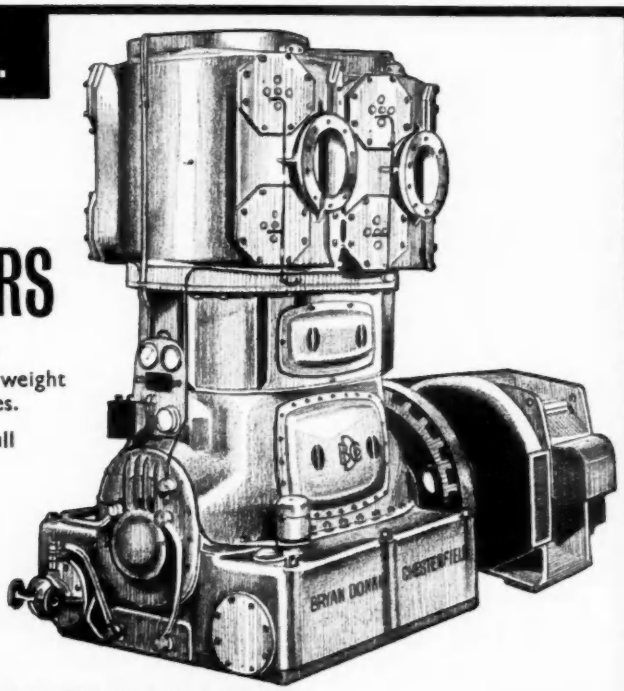

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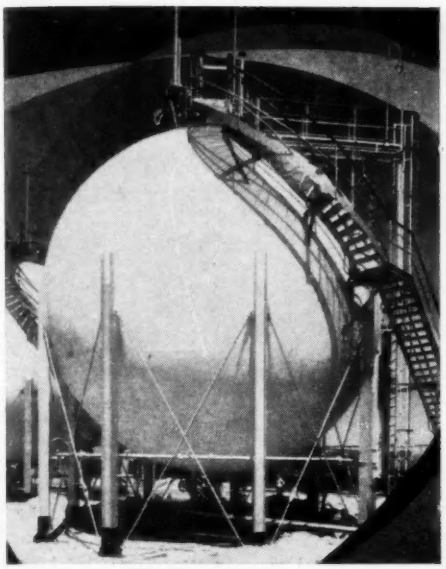

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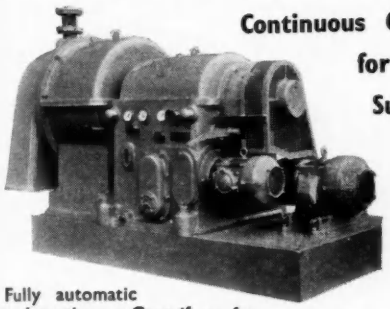

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CONTENTS

EDITORIAL COMMENT

New thinking on pre-set cookers - - - - 103
Architectural event - - - - - - - 104
Reformed character - - - - - - - 104

CHEMICAL AND BY-PRODUCTS SURVEY

Road tar and its applications, by P. S. Ledger Lee - 105
Coal tar preservatives for wood and metal, by N. A. Richardson - - - - - - - - 108

SPECIAL ARTICLE

Sell gas central heating, by W. F. Coxon - - 114

NEWS SUPPLEMENT

Coal science lecture - - - - - - - 117
First class heat—by gas or solid fuel - - - 118
Guernsey's new catalytic reformation plant - - 119
Correspondence - - - - - - - - 120
Personal notes - - - - - - - - 120
Coming events - - - - - - - - 120
Obituary - - - - - - - - - 120

Editor :
GEOFFREY W. BATTISON

Assistant Editor :
WALTER F. TRUMAN

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PUBLISHERS' NOTICE, SEE PAGE 124

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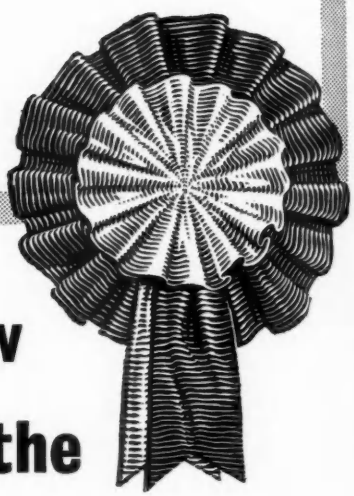

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Gas Journal

COKE OVENS • BY-PRODUCTS • CHEMICALS

New thinking on pre-set cookers

WHEN is the gas industry going to make up its mind about fully automatic cookers? From where we sit it looks as though gas boards are behaving with all the changeability of a prima donna. Only a year or two ago the success of the electricity industry with pre-set cookers panicked gas into trying to follow their example. A good deal of pressure was put on the manufacturers to perfect a gas version and, mid blood, sweat and tears, the thing was done. Flushed with success at solving a tricky technical problem, the makers waited for the industry to bring up its big guns and support their efforts with an all-out sales effort. What happened? Remarkably little.

Of course, there were difficulties. The models were expensive and a flood of troubles on the district caused dismay in some quarters. But, after all, events have shown that the public can be persuaded to buy high-price appliances, and the best way to reduce prices is to step up sales. As for the problems on the district, it immediately became apparent that the industry had not geared itself to deal with fitting and maintenance work of this kind.

At once it seemed there was a great shaking of heads. That is what happens when you meddle with electrical gadgets, said the conservative elements, who suddenly decided that this urge to mimic electricity was fraught with danger; better to concentrate on the natural advantages of gas and leave the gimmicks to the opposition. But some of them were prepared to look kindly on clockwork mechanisms which were free of all these foreign overtones.

It all adds up to the fact that the gas industry should never have embarked on such a drastic break with tradition without planning, preparation and experiment. Virtually no effort seems to have been made to solve the trade union and other difficulties associated with the fitting and maintenance of an electrical device tied in with a gas cooker before its launching. Equally little seems to be known about the technique of cold-start cookery; there was an absence of literature and, indeed, we have no knowledge of a British Standard dealing with this type of cooking. Finally, publicity of the new method was half-hearted.

The time has come, we suggest, for a serious re-appraisal of the situation. There is no blinking the fact that most buyers of electric cookers demand that they be fully automatic in operation; there can no longer be any shadow of doubt that what was once regarded in some circles as a passing fancy is a real and lasting customer requirement. Can gas afford to leave the provision of such a service to its competitors? Can past experience be regarded as having been based on a fair trial? Did the first fully automatic gas cookers have a chance? We think not.

In the past we have advocated the retention by the industry of attractive but uncomplicated cookers in their range, selling at the lowest price consistent with good quality and finish. We have not changed our views in this matter and to a considerable degree we support the views expressed by the reader who pleaded in *Gas Service* for 'more cheap, simple cookers, of good appearance, easy to clean, with a first-rate performance and without frills.' That correspondent criticised the gas industry for striving to make its cookers do everything that the electric cooker can do, and asked whether the money which has been poured into time-controlled cookery has been justified. The answer to that question is 'no,' but that does not necessarily imply that automatic cookers have no useful sales potential in the gas industry.

We would like to see a 'summit conference' created to discuss the whole question of future policy on this type of appliance. Such a conference would need to include representatives with special knowledge of district maintenance, particularly in relation to electrical services. Most important, the ladies must have their say —not only home service advisers but others who have independent specialised knowledge of current cooking habits and trends.

We would be happy to leave the decision on automatic cookers to a body of this kind. We are not necessarily advocating the promotion of this type of appliance. What we *are* doing is urging the industry not to discount the value of an appliance which has never been given a fair chance to prove itself under reasonable commercial conditions.

Architectural event

MUCH of the gas industry's future success depends on its being regarded with understanding, confidence and respect by the architectural profession, but it must be sadly admitted that, judging by results, the relationship between the two services—for architecture is as much a service as gas—has not been all it might be. Things are improving, however, and October 4 saw two events calculated to bring the harmony we desire a good deal closer to reality. They both happened on the same day. One was the opening of the newly designed Gas Section at the Building Centre and the other was the launching of the Gas Council's Gas Handbook for Architects.

The Building Centre exhibit is a very splendid affair and if we had to wait an uncommonly long time for its completion, well, it was worth it. To our mind it more than holds its own with its neighbour, electricity, possessing a richer, warmer, more colourful atmosphere, and has in its elegantly luxurious kitchen, a more compelling feature. Some of the detail looks very expensive, but that is all to the good; visitors to the Centre are not the type likely to be impressed by anything short of the best. Of course, we have minor criticisms: Large appliances raised on shelves can look unnecessarily cumbersome; some of the backgrounds to the fires are unflattering (the fireplace in the lounge looks positively drab); much more information should have been displayed with the appliances. And we have a private regret that the passer-by in the street still sees the bold sign 'Electricity' unchallenged by its rival (which is in a much better position to show it).

We have no wish to carp over these minor matters, however. A far better judge of contemporary design, Sir Basil Spence, went out of his way to heap praises on the designer when he opened the Section. He described it as 'beautifully designed and presented in a clean and simple way'. Let us leave it at that.

Sir Basil, who we suppose qualifies for the label 'top British architect', is the new President of the Building Centre. To hear such an eminent man in his profession enthusiastically describing the gas industry as 'a very virile and lively concern' and then going on to expound the virtues of room heaters, central heating boilers and fanned warm air, was very heartening. Just in case the gas message of new applications and higher efficiencies had not fully registered with the architectural audience, Sir Henry Jones, the Chairman of the Gas Council, hammered them home.

Sir Henry was in sparkling form the same evening when he introduced the Handbook for Architects to a select gathering at that most intimate and delightful of hostelries, the Bride of Denmark, whose labyrinthine little bars, containing a priceless collection of public house Victoriana are housed beneath the offices of the Architectural Press in Queen Anne's Gate. Here was yet another example of the way in which the Chairman of the Gas Council loses no opportunity of putting over the gas story. If conviction counts for anything, he is a very persuasive salesman.

This Handbook is a remarkable piece of work. It is a compilation of the gas supplements which have been appearing in the *Architect's Journal* over the past three years and probably represents the most comprehensive and scientifically presented manual of all gas services which has ever been produced. This information deserves the widest possible distribution, and although it is obviously intended for consumption by the architect, we would like to see a copy of the Handbook in the possession of every gas salesman. Where else can he find the services he has to sell described with such authority and at such length, yet with such an admirable and exacting economy of words?

Sir Henry made the point that today any handbook is out of date before it leaves the printers and announced that it could be kept up to date by the replacement or addition of supplements from time to time. One section which seems to us ripe for revision is that dealing with gas boilers, if only to include one or two illustrations showing just how uncluttered and pleasing the modern gas boiler can be.

Reformed character

IN these days of revolutionary technical developments it is something of an event to attend the opening of a traditional carbonising plant. That which was inaugurated at St. Albans last Wednesday has nothing special about it save two things. One is the fact that the plant was designed primarily to produce Cleanglow—1,500 tons a week is the potential—and the other is the exceptional spaciousness of the plant layout. We have seldom seen a neater arrangement or a handsomer retort house. As the photographs in last week's 'GAS JOURNAL' showed, the architect, Mr. Robert Neal, has done a very interesting and effective job, a far cry from some of the industrial cathedrals of not so many years ago.

Clearly the Eastern Gas Board is determined to impress the virtues of Cleanglow and Gloco on its influential customers. County planning officers, health committee chairmen, public health inspectors, and general managers of new towns abounded at the opening ceremony and the luncheon which followed. They heard Mr. J. H. Dyde, the Chairman, explain how the ideal coals had been selected after painstaking experiment and how Cleanglow and Gloco were to be made available in 28-lb. prepacked units not only from coal merchants but through hardware stores and garages.

Plans such as this go to emphasise the fact that we still have a two-fuel industry and that it must remain that way for some time to come. It may well be that coke and its near relations will help to bridge the gap between conditions today and the production of cheaper gas which we hope lies in the years not too far ahead. Nevertheless, it can hardly be denied that salesmen would prefer to give their undivided attention to selling the industry's prime fuel—gas. Perhaps they will find consolation in the fact that coke and its misdemeanours are becoming less a source of embarrassment. Indeed, judging by the events at St. Albans, coke seems likely to appear as, to quote Mr. Dyde, 'a greatly reformed character.'

CHEMICALS AND BY-PRODUCTS

Road tar and its applications

By P. S. LEDGER LEE, M.Inst.H.E.

Technical Officer, the British Road Tar Association.

IN the early years of this century tar was used on roads to control the dust nuisance caused by the motor cars which were then a novel feature of the countryside. The procedure in those days was fairly simple. Crude tar from the gasworks was dehydrated in pot stills and the resulting thin tar was sent out in barrels to be brushed on to the road; the tarred surface was covered with sand and if the tar came through in very hot weather, more sand was put on top. This method of treating roads was very effective and had the additional advantage that it waterproofed the road and prevented damage in frosty weather. The use of tar for this purpose soon became popular, but subsequently the demands made on road surfacings increased very considerably because of the great increase in the number, speed, braking power and weight of road vehicles. The tar industry has met this situation by improving the methods of production of road tar, by developing specifications not only for the tar itself, but also for the methods of using it, and by developing new methods of testing.

Fewer tar works

Fifty years ago road tar was made in a large number of tar works throughout the country by the simple distillation in pot stills of crude tar obtained from a large number of gasworks and coke ovens. Since then, mainly owing to the re-organisation of the gas industry, the number of works producing crude tar has diminished considerably, giving place to fewer but larger units. The number of tar distilleries has likewise decreased.

Many of the smaller works have disappeared and there has been a concentration in a limited number of larger works with the latest types of equipment, in which the distillation processes are carried out more efficiently and economically. These larger works are situated with due regard to the sources of supply of crude tar and the economical radius of delivery of road tar to customers.

The tar which is now made in coke ovens, horizontal retorts, intermittent and continuous vertical retorts, arrives in very large quantities by rail, road and water to the tar distilleries where it is generally blended to ensure a raw material of constant composition and distilled almost entirely in pipe stills.

Pipe still distillation

Distillation in pipe stills is carried out by pumping the tar continuously through a coil in a furnace. In its passage through the coil, most of the oils in the tar are vaporised and the material leaving the coil consists of a foaming mass of hot liquid soft pitch and oil vapours. The soft pitch is separated from the vapours which are then led into a fractionating column which splits them up into about six different fractions, ranging from crude benzole, through a variety of creosotes, to a very heavy creosote oil. Some of these fractions undergo further treatment and are then combined and later mixed in the desired proportions with the soft pitch to produce the many varieties of road tar required by B.S.76, which is the Standard specifying the properties of tars for all road purposes.

The properties of road tar have, of course, been changed as conditions on the road became more exacting. Many years ago it was sufficient for the tar to comply with the requirements of Road Board tars Nos. 1, 2 and 3. Since then the specifications have undergone considerable changes. The British Standard No. 76 'Tars for Road Purposes' was originally introduced in 1911-12 and five revisions, each laying down more stringent requirements, culminated in the current edition which was issued in 1943,

Spraying hot tar to seal road foundations.

CHEMICALS AND BY-PRODUCTS

with several amendments up to 1955, and is now under further revision.

Road tars are made in two types depending on the purpose for which the tar is to be used—*i.e.*, surface dressing or tarmacadam—and in a wide range of viscosities to suit the weather conditions and the kind of tarmacadam to be made. The user of road tar usually specifies the particular type and viscosity of tar which he requires and he asks that it shall conform to this British Standard.

Distillers recognise the necessity for making frequent analytical tests to ensure that the tar complies with the specification. The results of the tests are recorded and samples of the tar delivered are kept to help the customer in the unlikely event of any complaint of the behaviour of the tar on the road.

Road trials

The development of such a specification as British Standard No. 76 has been possible only by a scientific examination of the properties of tar and by amending requirements to ensure the suitability of the product. In addition, many road trials have been carried out in co-operation with the highway authorities and the Road Research laboratory to determine the performance of the different grades of road tar under different concentrations and types of traffic.

The tar industry is greatly indebted to the Committee which has been in existence for 30 years for the standardisation of tests for tar and its products. This work has been done by some of the best scientists in the industry, and the book embodying these tests has become a standard work of reference, not only in this country but in many parts of the world.

Measurement of the viscosity of tar, which is one of its most important properties, was not very difficult in the early days but has had to receive special consideration to meet the demand for tars of a wide range of viscosities. It is probably true to say that no other industry, except the petroleum industry, is concerned with measuring the viscosity of its products over such a wide range. About 30 years ago the tar industry put forward the conception of equi-viscous temperature which enables the viscosity of any tar product from a thin tar to a pitch to be expressed on a single scale, and this system—the e.v.t. system—is now in common use not only in this country, but also abroad.

Bulk delivery tankers

Although a small quantity of tar is still sent out in drums, this method of delivery is almost a thing of the past. Nowadays the various road tars manufactured on a tar works are stored in large heated tanks; from these tanks it is loaded into road tar sprayers, with capacities of 1,500 to 2,500 gal., or lagged bulk delivery tankers which deliver the tar to tarmacadam plants where it is maintained at the required temperature by steam or electric heating.

When Telford and McAdam reconstructed British roads prior to the introduction of the railways, they laid a thickness of broken stone with a thin layer of small stone as a final surface. This was not rolled and the iron shod wheels of the horse-drawn wagons and carriages ground down this top layer of small stone into smaller particles and dust. In wet weather this dust formed a slurry, which penetrated the voids in the layer of larger stone, thus forming what we know as waterbound macadam.

This method of surfacing is very susceptible to changes in the weather. If the optimum moisture content is exceeded by the penetration of rain-water the macadam loses its stability, and ruts form under the wheels of passing traffic. Alternatively, if the sun dries out water from the macadam, the fine particles binding the other stone together are drawn out by passing traffic in the form of dust.

During the 'railway age' traffic was greatly reduced on the roads, and road work was mainly confined to paving local roads to feed the railway stations. In this connection it is recorded that tarmacadam made with 'gas-tar and heated gravel' was laid in Nottingham in 1840.

With the invention of the internal combustion engine, and the introduction of the 'horseless carriage' at the beginning of the century, dust really began to fly from the water-bound roads, and as a result of public demands another and more efficient binder was found to 'lay the dust.' This binder—tar—was obtained locally from one of the many small gasworks which then covered the country, but soon an improved material was required to make a dressing capable of resisting the action of increased traffic. The tar industry provided better tars for this purpose, but the technique of road making developed to such an extent that not only the surface of the road but the whole thickness, including the soil itself, had to receive consideration.

At this point it is desirable to explain the construction of a modern road. All that the driver usually sees is the wearing surface, and this has to be smooth (but non-skid) and durable. These properties would not last very long, however, unless the wearing surface was adequately supported and unless the soil itself was capable of bearing the weight of the traffic. Most soils can carry a reasonable load only if the water content is kept within certain limits; if they become too dry or too wet they are easily deformed. It is, therefore, often necessary to protect the soil during the initial stages of laying a road, and this is done by spraying the soil with road tar.

Granular foundations

On this surface are put layers of granular material to form the foundation of the road. These layers can be laid dry or bound with tar, cement or water and together serve two purposes; the fifst is to build up the level of the road to the desired extent and to fill up any hollows in the soil. The second purpose is to provide a mass of material which will even out the load of the traffic so that the weight ultimately transmitted to each sq.ft. of the soil is no greater than it can carry. This is a most important matter in the design of roads; the total thickness of these layers is calculated by a formula based on the known bearing strength of the soil and the traffic to be carried.

On many soils it is so important to prevent the entrance of water that the foundations are often sealed by surface dressing with tar. This matter has been the subject of a recommendation by the Road Research laboratory in Road Note No. 17, H.M.S.O. 1953. During the construction of M.1 the sections of the foundations which had to be left uncovered until the wearing surface was put on at a later stage were sprayed with hot tar and covered with sand, thus effectively preventing the penetration of water and possible damage by frost during the winter.

Most people think that the only purpose of tar spraying is to provide a durable wearing surface on roads, but actually tar spraying plays an important part throughout.

Surface dressing is the operation of spraying tar in a thin film on a road surface, covering the film with stone chippings and rolling them in. This treatment seals the road against the entry of water and provides a non-skid

surface which will last for many years. It is applied to water-bound roads and to asphalt and macadam wearing surfaces which after many years of life show signs of disintegrating and require some treatment to prevent further deterioration.

The modern methods of surface dressing roads are the result of years of research and experiment to find out the methods and materials best suited to the purpose. These investigations have led to the publication of two documents, one of which—'Recommendations for Surface Dressing with Tar'—has been issued by the Road Research laboratory as Road Note No. 1, and the other—'The Technique of Surface Dressing with Tar' has been published by the British Road Tar Association. Both of these deal with the details of the application of the dressing and the selection of those materials most suitable for the actual conditions on the road to be treated. The work involved is to apply tar to the surface and cover it with chippings which have to be held against the action of passing traffic.

Pressure spraying

The most important factor in this operation is the quantity of tar necessary to waterproof the old surface and provide a good hold on the particular size and shape of chipping which is to be used. The tar was applied originally by brushing it onto the road, but the modern method calls for spraying. If the area is small or difficult in shape a hand operated sprayer is satisfactory in good and knowledgeable hands, but it is now more usual to apply the tar from tank sprayers fitted with a spray bar which applies the tar under pressure through a series of jets.

During the last few years there has been a great improvement in the efficiency of these machines, but not so long ago it was quite common to see where chippings had come away from a dressing in long streaks where a jet had failed to operate properly. Methods have been developed for testing the transverse distribution of spray bars. The forward speed of the machine is controlled by a special speedometer, tachometer or other device to enable the thickness of the tar film applied to the surface to be both correct and consistent.

Open-textured carpets

Surface dressing with tar was in general use for all classes of road until the introduction of 'open-textured carpets' prior to the last war. These thin carpets then became most popular because they not only provided a new surface texture, but they also improved the running surface of the road by levelling-up local depressions or corrugations in the old surface. This method of resurfacing retained its popularity in the post-war period until it was found that the open-graded mixture was not giving the life which had been anticipated, so that during the last two or three years surface dressing with tar has become increasingly popular again. This is particularly noticeable in work on trunk roads carrying fast and heavy traffic.

An instance of this is the work done on A.4 (Great West Road), which is the main exit from London to the West, including London Airport. The traffic using the road amounts to 130,000 tons per day of all types, including heavy industrial vehicles. The old surface had become dangerous because the traffic had polished the surface, and a surface dressing of tar and $\frac{3}{8}$ in. tarred chippings was applied which overcame the trouble.

Because this surface-dressing had to be applied during hot weather, without closing the area to the fast and heavy traffic using the road, a very viscous tar was sprayed,

CHEMICALS AND BY-PRODUCTS

and covered with chippings which had previously been mixed at high temperature with a small quantity of tar. This insured that the tarred chippings adhered immediately to the film of tar which had just been applied to the surface of the road, so that the tar held the chippings against the action of traffic which used the new surface immediately after the treatment had been applied.

Such treatment has proved most successful in other parts of the country, because it not only provides a new non-skid texture, but it also rebinds and waterproofs the existing surfacing, and by prolonging the life of the road at low cost it provides a most attractive and economic form of maintenance.

The most modern forms of surface dressing techniques have therefore gone a long way since the early days of hand applied dressings of thin fluid tar. The use of high viscosity, *i.e.*, stiffer, tars and tarred chippings against severe traffic stresses such as may be experienced on acute bends, roundabouts and where hard braking is likely to take place, does not mean that this method is necessary under all conditions. Many thousands of miles of surface dressing are carried out each year using tars of medium viscosity in conjunction with chippings not pre-treated with tar.

Determination of quantity

The most important factor in any type of surface dressing is clearly the application of the correct quantity of tar. This is calculated on the quantity of tar required to hold the chippings in place having regard to the size that is used, the proportion of the tar which is likely to be absorbed by the road surface (so that sufficient remains to hold the chippings) also the degree of initial penetration of the chippings under the roller and subsequent traffic (so that the tar does not flood over the top of the chippings) and, for the latter reason, the actual shape of the chipping, *i.e.*, cubical, flaky or round.

The success of the dressing in providing a consistent non-skid surface texture depends upon the adhesion of the chippings to the film of tar. For this reason it is important that chippings are dry and free from dust, but unfortunately in practice British weather conditions do not always help. Even if it is not raining when the work is carried out adhesion is often affected by subsequent rainfall before the tar has obtained a full hold on the chippings. Certain chemicals are available which increase the speed of adhesion, but the 'set' of the tar itself may not be sufficiently rapid if vehicles do not reduce speed, and avoid severe braking when travelling over newly treated roads. A disinterested or ignorant motorist can do a lot of lasting damage in a very short time.

The second method of using tar in road construction is in the manufacture of tar coated aggregate or tarmacadam.

The development of tar-coated aggregate or tarmacadam is almost a subject in itself. It started many years ago; there is a record of tarmacadam having been used in Gloucestershire in 1832, but if the same mix were used today it is most unlikely that it would stand up to present-day traffic conditions. In the past one has often seen the wheels of passing traffic cutting ruts in newly laid material and the efforts to deal with this problem have led to the adoption of tarmacadam mixtures which have greater initial stability, enabling them to support the traffic loads without movement or deformation.

Higher stability and better load spreading characteristics are obtained by the use of tars of higher viscosity and by the inclusion of more fine aggregate and filler in the tarmacadam mixture; these precautions ensure a high density of the mixture on the road after compaction by the roller.

Some years ago the knowledge of the properties of tarmacadam developed to such an extent that British Standards could be drawn up. These standards are Nos. 802: 1958, 1241: 1959 and 1242 which is now under revision, and they provide specifications for tarmacadam with open- and medium-graded aggregate mixtures, suitable for most conditions. In 1959, the B.R.T.A. supplemented these Standards by issuing specifications for hot-laid medium and close-graded types of tarmacadam which were accepted by the Ministry of Transport. These latter specifications, and the well-known 'dense tar surfacing' which will be referred to later, are included in the new recommendations by the Road Research laboratory resulting from a study by the Pavings Committee of the Road Research Board. From this catalogue of the information which is available to the highway engineer, it will be realised that a wide range of tar-coated materials is available to meet the various requirements for roads carrying all types of traffic.

Sometimes the wearing course material which is laid over tarmacadam base course is hot rolled asphalt; sometimes it is dense tar surfacing. Both these materials have to be laid and rolled while they are still hot and it is one of the features of certain types of tarmacadam bases, developed in recent years, that they do not deform under the hot wearing course while it is being laid.

Dense tar surfacing, often known at D.T.S., is a dense and impervious material which has become increasingly popular since the war. It differs from tarmacadam, as a layman knows it, in two respects; it is made, laid and rolled at high temperature and consists of a carefully chosen mixture of aggregates of all sizes and of fine mineral dust mixed with a tar of high viscosity. When the dense tar surfacing is cold it possesses a high degree of mechanical stability, both because of the framework of stones, and by reason of the stiffness of the tar which binds the stones together. These characteristics not only ensure that it will withstand high traffic loads immediately after it is laid and is cool, but will also guarantee that it will give a good wearing surface for many years.

Dense tar surfacing still continues to increase in popularity as a dense impervious wearing-course which is giving good service on trunk, county and municipal roads. The Royal Air Force and the Admiralty have proved the resistance of dense tar surfacing to the effects of the spillage of jet fuel, and petroleum companies have successfully used the material for their depots and tanker-standings. For the same reason surfacing materials with tar as the binder are becoming increasingly popular with architects and surveyors interested in the provision of car parks to relieve congestion on their roads.

To sum up, the road tar industry is taking an important part in the development of British roads, and materials and methods now recommended by the Road Research laboratory, in which road tar is used, are included in specifications for all classes of road work undertaken for Government departments and local authorities throughout the country.

Coal tar preservatives for wood and metal

By **N. A. RICHARDSON,**
B.Sc., A.R.I.C.
Technical Adviser, Association of Tar Distillers.

MANY chemical substances have been suggested at one time or another for the preservation of timber, but those that have found wide or general application are remarkably few. Coal tar creosote is, however, outstanding in this respect having been in continuous use now for well over 100 years. In fact the history of wood preservation is, to a very large extent, bound up with that of creosote and pressure creosoting. Creosote is still the most important and widely used wood preservative, never having been seriously challenged by any other preservative for the protection of timber used externally or under severe conditions of exposure. Millions of gallons are utilised every year in all parts of the world for the preservation of railway sleepers, transmission poles and marine timbers against decay, insect attack or marine borer damage. Creosote is the standard preservative for all such timbers.

Pressure creosoting may be said to have begun with the granting of a British patent to J. Bethell in 1838, which in the main claimed the impregnation of timber by a vacuum and pressure method with 'dead oil of tar,' a high boiling distillate of coal tar which later became to be known as creosote. The rapid development of the railway systems in the 19th century, starting with the opening of the Stockton-Darlington line in 1825, coincided with an equally rapid expansion of the gas industry, and so an increasing supply of creosote became available to meet the additional demands for the preservation of wooden sleepers. During the early years of the railways it was soon found that untreated wooden sleepers decayed within a short time so that an urgent need arose for a wood preservative that would prevent this decay and provide a long life for the sleepers. It is hardly surprising that literally hundreds of chemicals were suggested for the purpose and numerous patents taken out at that time, but it is significant that the only method to survive up to the present day is the creosoting process introduced by Bethell some 122 years ago.

With such a long history behind it, it is natural that there are very many records of the long life of creosoted timber even when used under the most severe conditions. As an example some portions of elm piling that had been pressure creosoted in 1853 were recovered at Southampton Docks a year or two ago in a perfectly sound condition. There are also many known examples of creosoted telephone poles and fencing material being in sound condition after 80 years or more in service. In 1957 the Koppers Company of America purchased some old Post Office

creosoted telephone poles that had been taken down after 63 to 64 years in the line and which, when recovered, had been classified by the Post Office engineers as 'fit for re-use.' The poles and the creosote extracted from them have been the subject of tests by research workers at the Koppers Company and the U.S. Forest Products Laboratory and a study of the results should provide some interesting information on some of the reasons why creosote has proved so outstandingly effective as a preservative.

The organisms responsible for the deterioration of timber in service are (a) wood-destroying fungi, (b) insects (including termites) and (c) marine borers. Fungi are a low form of plant life some of which are capable of attacking wood and other cellulose-containing materials. When actively growing, these fungi develop hair-like threads, known as hyphae, which penetrate and disintegrate the cell walls and render the wood eventually to a soft spongey mass or even powder. Under favourable conditions fruiting bodies are formed from which millions of minute spores (seeds) are liberated to be distributed in the air. When these spores settle in moist timber they start to grow and fungal infection is spread in this way.

Regulating fungal growth

However, wood destroying fungi require certain defined conditions of temperature and moisture, as well as a food supply for their development, and if any of these can be suitably controlled, fungal growth can be regulated or even prevented. Thus conditions can be either too wet or too dry for the decay of wood by these fungi, so that in practice we find that the lower ends of piles in fresh water, or furniture or roofing timber, do not normally suffer from decay. In the former the wood is too wet while in the latter it is too dry. Some fungi are able however to extract sufficient moisture from the air with the result that having started to grow in damp wood, they can spread and attack wood that is too dry for the normal fungal attack. The common dry rot fungus *merulius lacrymans* is of this type.

If timber can be kept dry, *i.e.*, a moisture content below about 20%, in use it will not normally be subject to fungal attack, and it should be the aim of good design and construction to ensure that, where possible, dry or seasoned timber should not be allowed to become wet in use. Where it is not possible to do this the food supply of the fungi, *i.e.*, the wood itself must be impregnated with a substance poisonous to the fungi.

Insect damage

The most common of the insects causing damage to timber are the common furniture beetle and the *lyctus* powder-pest beetle. As a rule these do not, however, cause as much damage to structural timber as fungal decay. Termites, more popularly known as white ants, are responsible for much damage to timber in tropical countries, but do not occur in the temperate climate of the United Kingdom.

Marine borers attack timber in salt or brackish waters but are not found in fresh water. The most common of these animals are the *teredo* or ship worm and the *limnoria* or gribble, both of which cause considerable damage to sea water piling and wharves unless preserved timber is employed in their construction. Coal tar creosote has proved to be the most effective preservative against this form of attack and is the standard preservative in all parts of the world for timber marine structures. Mixtures of creosote and coal tar have been found to be particularly effective where the incidence of *limnoria* attack is high.

A good wood preservative should have a number of desirable properties, the most important of which are as follows. First it must be toxic to the various wood-destroying organisms, fungi, insects, etc. Secondly the toxicity should possess a high degree of permanence. Thirdly it must be capable of penetrating wood reasonably well, *i.e.*, it must not be to viscous. Fourthly it must be readily available and as cheap as possible. Other desirable properties are that it should be non-poisonous to human beings and animals, non-corrosive to metals and not render wood highly-inflammable.

CHEMICALS AND BY-PRODUCTS

Coal tar creosote meets these requirements very well but there is little doubt that its outstanding features are its chemical stability and permanence; creosote has become the standard by which all other preservatives are judged. There are other preservatives which are more toxic to wood destroying organisms but which fail when used under exposed conditions, since they are removed from the wood by leaching or evaporation. Reference has already been made to the long life of creosoted timber in service.

Coal tar creosote is a very complex mixture of high boiling oils containing hydrocarbons, tar acids, and bases, and as such does not therefore rely on just one or two substances for its toxicity towards the various organisms that destroy timber.This is no doubt the reason why these organisms have not been able to develop any degree of immunity towards creosote.

Creosote constituents

Well over 150 different chemical compounds have been identified in creosote, and considerable research has been directed towards establishing whether some constituents are more important than others. At various times in the past emphasis has been given to the importance of different constituents, *e.g.*, phenols, napthalene, etc. but it is now generally agreed that all the usual constituents play some useful part, and that any genuine coal tar oil boiling above 200° C., from coke oven, horizontal, vertical or low temperature tars, can be relied upon to satisfactorily preserve wood for a very long time even under the most severe conditions of exposure.

The view has occasionally been expressed that the improvements in coal carbonisation methods and tar distillation practice over the years has resulted in material changes in the composition of creosote, but this is not borne out by the facts. The heavy oil fractions of coal tar providing the creosote of today are essentially the same as those specified by Bethell as 'dead oil of tar.' Modern tar stills do, however, enable the distiller to provide, if necessary, closer blends of oil to meet the various creosote oil specifications and also readily to produce oils best suited for a particular purpose, *e.g.*, lighter oils for transmission poles or heavier ones for sleepers and marine timbers.

There are appropriate specifications for creosote for timber preservation in all parts of the world, and in this country B.S.144 (1954) describes the creosote used for the impregnation of railway sleepers, poles, marine timbers, fencing, etc.

All these specifications consist of a few simple clauses, and their purpose is to ensure that a genuine high boiling coal tar oil suitable for the impregnation of timber by the normal methods is supplied. Although creosote is a highly efficient preservative for timber it must be realised that, as with any other preservative, the actual treatment given to the timber has a most important bearing on the results

CHEMICALS AND BY-PRODUCTS

obtained. Timber thoroughly impregnated with creosote will naturally give better results than timber merely coated on the surface, but the degree of impregnation is in practice adjusted to suit the use to which the timber is put and consequently the conditions of exposure. Creosote can be applied by either surface or impregnation treatments, and these are briefly described in the following notes.

Surface treatments such as brushing or spraying only result in skin-deep penetration of the timber except perhaps in the case of sapwood of the more absorbent species. Such treatments are, therefore, only of limited value and are quite unsuitable where the timber is required to be used under exposed conditions. Timber *in situ* can only be treated in this way and when brushing or spraying, the liquid should be applied liberally to all surfaces of the timber, not forgetting joints and end grain, and applied hot if this can be done.

Open tank treatments

Steeping or open tank treatments are used where pressure treating facilities do not exist, and if carried out intelligently can give good results. The open tank is the better and quicker method, and timber can be creosoted as follows. The timber is kept immersed in creosote oil contained in a convenient iron or steel open tank which can be heated by steam coils or an open fire. The creosote oil is heated to a temperature of about 180°F. and maintained at this temperature for about one hour. During this period the air in the cell spaces of the wood—in many species this represents about 50% of the volume of the wood—expands and can be observed bubbling in the liquid. If the creosote is then allowed to cool, it will be sucked into the timber to an extent depending on the difference in pressure of the air inside and outside the timber. A similar treatment is often carried out in an old oil drum to creosote the butt-ends of fence posts so that the part of the posts most liable to decay, *i.e.*, at and below ground level, is given a heavy treatment. The upper parts are brush treated or dipped.

Pressure plant

The open tank method of creosoting will give excellent results with absorbent species and is a very useful method for impregnating timber with liquids. Better and more consistent results can be obtained, however, by forcing the creosote oil into timber by means of pressure, and this method is used as standard for the treatment of transmission poles, sleepers, marine timber and wood block paving and flooring. When the quantity of timber being handled is large the capital outlay of a pressure plant can soon be justified, since besides affording the most effective method of preserving timber, the treatment can be carried out in much less time and with more control. Commercial treating cylinders in use in this country are made up to 100 ft. long with diameters of up to 7 ft.

The methods of pressure creosoting can be divided into two types, the 'full cell' and 'empty cell' methods. The full cell process, which is also commonly known as the Bethel process after John Bethell who first introduced it in 1838, is widely used where a maximum life is required of the timber under the most exposed conditions, *e.g.*, marine structures.

The timber enclosed in the pressure cylinder is subjected to a vacuum of from 15 in. to 28 in. of mercury for a period of a quarter to two hours. Following this the cylinder is filled with coal tar creosote at a temperature between 150°F. and 200°F. and at pressures of from 100 to 200 p.s.i. applied for a half to five hours or longer, depending on the kind of timber being treated and the purpose for which it is to be used. After emptying the cylinder the timber is subjected to a short final period under vacuum in order to remove surplus creosote from the surfaces. In this country all marine piling and most railway sleepers are creosoted by this method. Baltic redwood sleepers are impregnated on the average with 10 lb. of creosote oil per cu.ft. of timber, *i.e.*, by about 3 gal. per sleeper.

Two 'empty cell' methods, known as the Rueping and Lowry processes, are in every day use, although the former is the more commonly employed in this country. These treatments differ from the 'full cell' method in that no initial vacuum is applied to the timber. With the Rueping process—first used in 1902—the timber is subjected to an air pressure for a short period after which the cylinder is filled with creosote while the air pressure is maintained. Creosote is then forced into the timber by increasing the oil pressure which is not released until the required absorption has been obtained. The air compressed in the wood expels the excess of creosote in the timber when the creosote oil pressure is released with the result that very much less creosote is left in the wood than when the 'full cell' method is employed. Deep penetration of the timber without using high absorptions is the main advantage of this process, and telephone and other transmission poles are normally treated in this way.

Conditioning process

The Lowry process involves neither a preliminary vacuum or air pressure period. The cylinder containing the timber to be creosoted is filled with hot creosote oil and pressures applied until the required amount has been injected. The air originally present in the wood is compressed during the pressure period, and when the oil pressure is released this air expands and in so doing pushes out a proportion of the creosote injected into the timber. The amount ejected is, of course, much less than with the Rueping process.

It should be mentioned that before timber can be impregnated with creosote or indeed any other preservative it must first be dried or seasoned. It is considered to be beyond the scope of this article to describe seasoning methods in detail, but one conditioning method that is confined to creosoting might be of interest. This is the Boulton or 'boiling under vacuum' process which, though not extensively used in this country, is sometimes used in the treatment of large size piling timbers. It is, however, the chief method used on the west coast of the U.S.A. and Canada for the treatment of Douglas fir and hemlock. The Boulton process takes its name from its inventor, S. B. Boulton, who patented it in 1879 and consists of immersing the green timber in hot creosote and applying a vacuum. Under the reduced pressure moisture is removed from the timber at a temperature below its normal boiling point and in a matter of some 12 to 24 hours sufficient moisture is removed from the outer layers of the timber for it to be treated in the same cylinder by the usual pressure creosoting processes.

It is not always realised that, even by pressure application of the creosote oil, it is not always possible to penetrate the woods deeply. Woods differ greatly in their penetrability, some being almost impervious while others can be completely penetrated. Generally speaking the sapwood of most species, which has little durability, is readily penetrated, and the heartwood is usually more resistant.

Douglas fir is a timber that is used under conditions where it has to be creosoted, but it is very resistant to impregnation. A number of methods have been suggested from time to time for improving the penetration of creosote oil into Douglas fir, but the method known as incising is the one employed today. This consists of making narrow incisions, usually about ¼ in. deep, over all lateral surfaces of the timber by passing it under a spring-loaded roller from which project the incising knives. The incisions are so spaced as to allow the creosote oil to penetrate the ¼ in. of the incision and then spread in all directions to penetrate the wood uniformly to the depth of the incisions.

B.S. 913 (1954), The Pressure Creosoting of Timber, specifies recommended absorptions of creosote for different species and classes of timber which are based on experience extending over many years, and any pressure creosoting of timber should be carried out in accordance with this specification if the best results are to be obtained.

Metallic corrosion

Coatings based on coal tar pitch have, for the past 100 years, been extensively used for the protection of metallic artefacts against corrosion. Such coatings range from the cold applied tar paints or 'black varnishes' to the hot applied plasticised pitch enamels designed for situations where corrosion is abnormally heavy. They all possess to a greater or lesser degree the same advantages—excellent adhesion to metal surfaces, imperviousness to penetration by moisture resistance to weak acids, alkalis and petroleum oils, resistance to bacterial or fungal deterioration and, above all, cheapness. Their intrinsic defects are that they are black, that their plastic range is comparatively restricted so that they tend to flow at high atmospheric temperature and become brittle at low atmospheric temperature, and that they are not unaffected by prolonged weathering. Nothing can be done about the first disadvantage; tar paints, like the cars manufactured immediately after the war, can be supplied in any colour—provided it is black. The temperature range between the flow point and brittle point of tar paint films and their weathering resistance can, however, be improved by various means.

Black varnishes

Black varnishes are the simplest and cheapest form of coal tar coating composition. They are prepared by blending a medium soft pitch with a small amount of a coal tar heavy fluxing oil and diluting this mixture to brushing or spraying consistency with a compatible solvent—generally a coal tar xylole or naphtha. They are applied cold without primer or with a red lead priming coat and will give excellent protection, even in highly corrosive atmospheres, for a number of years. They are extensively used for painting industrial structural steel work, as anti-fouling compositions for ships' bottoms and for water-proofing concrete. They harden by evaporation of the solvent to a hard, bright tenacious film which, if access of light and air is excluded, retains its shiny appearance almost indefinitely, but under the influence of atmospheric agencies becomes dull after a few months and gradually hardens and contracts on the surface to give a reticulated appearance. This 'crocodiling' does not destroy the protective purpose of the coating since the cracks do not penetrate to the surface of the metal, but it does impair the appearance, and many proprietary tar paints contain additives to minimise this effect.

The incorporation of finely divided mineral fillers, such as talc, slate flour and lampblack, the addition of small amounts of elastomers such as chlorinated rubber or P.V.C.

CHEMICALS AND BY-PRODUCTS

or the digestion of small amounts of coal in the pitch all improve the durability of tar paints and, in addition, generally improve their elasticity at low temperatures and their resistance to flow at high temperatures.

Where a wide thermal stability range is necessary a very hard pitch, produced either by distillation or by air-blowing cut back with a suitable solvent, can be used. A composition of this type under the name of Plastix is extensively used in Germany as an anti-corrosion coating in industrial installations where very corrosive atmospheres are experienced.

Pitch emulsions, usually prepared by emulsifying a medium soft pitch with water in presence of a finely divided clay and an emulsion stabiliser, represent another type of cold applied tar composition which, although not so widely used as the solvent based black varnish, is employed successfully for the corrosion protection of metals.

For very severe conditions, for example the long term protection of buried pipelines, hot-applied coal tar enamels are generally used. These are formulated by dispersing 15 to 25% of a bituminous coal at 300 to 350°C. in a coal tar pitch-heavy fluxing oil mixture and adding mineral filler. In Germany, where they have been used extensively for pipe-coating and for undersealing cars and rail wagons, they go under the trade name of Synoplast; in America where they are almost universally used for the protection of buried oil and natural gas pipelines, they are often referred to as 'A.W.W.A. plasticised coal tar pitch enamels,' indicating that they meet the stringent specifications for adhesion, flexibility and resistance to flow embodied in the American Water Works Specification C 203-57. With such materials it is essential to use a suitable primer which is generally a fluxed coal-pitch dispersion cut back with a coal tar naphtha. They may be applied by flood coating or by flame spraying and when applied to underground pipelines are generally sealed with a coal tar impregnated fibreglass wrapping.

Recently pitch-epoxy resin coating compositions have been developed, and very attractive claims are made for these materials. While much more expensive than tar paints or plasticised pitch enamels, since they contain at least 40% of the expensive epoxy resin, they are more difficult to apply, in that the solvent containing the hardener must be mixed with the pitch-epoxy resin composition immediately before application, but their adhesion and flexibility even at low temperatures is outstanding. It is perhaps too early yet to assess the full possibilities of these new materials, and undoubtedly they have suffered up to date because of exaggerated claims. There is no doubt, however, that they give excellent protection of steel to alkali, acids, and a number of the commonly used industrial solvents and their value as an anti-corrosion coating for chemical equipment, pickling tanks, etc., has been demonstrated. On the other hand their adhesion to brass, copper and zinc is reported to be poor, and they are not resistant to aromatic materials or oxidising agents. There is also some doubt as to their long term weathering resistance. Their higher cost is to a large extent offset by the fact that a single thin coat gives as satisfactory protection as several coats of tar or bitumen paint, and the pitch-epoxy resin film does not sag or crocodile and maintains its bright appearance. It is also claimed that pitch-epoxy resin paints can be over-painted with ordinary paint and will not, unlike other types of tar paint, bleed through. **(References: See page 116.)**

W. F. COXON, M.Sc., Ph.D., A.M.Inst.Gas E., in this article says that the mass central heating market—or more accurately the semi-central heating market—is likely to be met by installations providing 20,000 B.t.u. an hour for smaller houses, to 45,000 B.t.u. among the larger, with the 30,000 B.t.u. installation being a popular best seller. It is in these markets that he compares the merits of competitive fuels and urges . . . .

SELL GAS CENTRAL HEATING—

FOR several months Mrs. 1970 on behalf of the Shell oil organisation, has been preaching the gospel of the virtues of central heating. Likewise the Coal Utilisation Council has been drawing odious comparisons between the running costs of various fuels. Quite recently the Gas Council and the Area Gas Boards have drawn the attention of the public to the advantages of gas central heating.

Meanwhile there have been no authoritative and quite impartial figures published on real capital costs and real running costs for the various fuels. Such figures have indeed been published by one interested organisation, giving the costs for the cheapest fuel prices in the country for the fuel that is being sponsored and the highest prices for the fuels of its competitors!

However, these anomalies have now been removed as a result of an impartial publication for the Institution of Heating and Ventilating Engineers entitled 'Central Heating in Your Home'. Here all the various fuels and installations are dealt with quite impartially.

Ten-year period

The summary of costs offered by the Institution suffers, I think, from one minor disadvantage in the sense that the capital and running costs are commuted over a ten year period. Since the majority of central heating installations will undoubtedly be bought on a hire purchase basis it would seem more advantageous to the customer to present him with his total capital and running costs over the five-year purchasing period, and then with his running costs, including service charges, over the subsequent years, because this reflects the actual payments he will make.

With this object in view, the figures published by the Institution of Heating and Ventilating Engineers have been represented in the form of the table accompanying this article.

Considering the mass market, what is intended when the term central heating is used? It is not accidental that Scandinavia and the United States have been central-heating-conscious for a number of years—the fact is that throughout the whole of Scandinavia and larger portions of North America the seasons are clearly defined. They know that within a few days of a certain month in the year that the temperature will drop and remain at a low degree for an appropriate number of months. In such circumstances full central heating is installed and operated for the appropriate period.

In this country the problem is somewhat different due to our peculiar geographical situation. High temperatures on Christmas Day and a cold July are far from uncommon. The sudden freeze-up is usually of relatively short duration and if it lasts for a week or so it becomes a year of catastrophe—the last one we had in this respect was about 15 years ago.

Thus, in the approach to central heating these figures must be borne in mind, since it is obviously uneconomic to budget in terms of national capital costs for a set of circumstances which prevail for two or three weeks every 15 or 20 years. In the balance it would seem that in so far as this country is concerned the conception of the mass central heating market is a central heating boiler, a heated towel rail in the bathroom, a radiator in the hall, and one or two radiators in the living rooms.

Impartial figures show its cheapness

The rest of the heating is intermittent, depending upon the outside temperature and the specific requirements of the individual householder at the particular time. Thus it seems true to say that the mass central heating market or, more accurately, the semi-central heating market, is likely to be met by the installations providing 20,000 B.t.u. per hour for the smaller house to 45,000 among the larger, with the 30,000 B.t.u. installation being a popular best seller.

It is in these markets, it would seem, that the merits of the competitive fuels should be compared, and from the findings of the Institution of Heating and Ventilating Engineers they are most elucidating.

For a 30,000 B.t.u. small bore installation the total capital costs are: Coke £300, anthracite £350, oil £385, gas £290.

If these total charges are divided by 5, the comparative annual capital costs over five years are: Coke £60, anthracite £70, oil £77, gas £58.

Add to the above figures the fuel costs in these five years

during which the equipment is being purchased, and the service charge for the oil and gas installation, and the total annual costs over the first five years are: Coke £90—104, anthracite £98—108, oil £121—123, gas £100—115. These are the real operative figures for the first five years.

Subsequent to this the householder will be paying for fuel and service only and the fuel and service costs for the respective fuels are: Coke £30—44, anthracite £28—38, oil £44—46, gas £42—57.

In other words, in this 30,000 B.t.u. market gas, on a straight cost basis both in the first five years and subsequently, is in a very competitive position with oil.

It is necessary to emphasise the advantages of gas in use, namely time clock control, no fuel storage space or tank, no ashes to remove, less burner maintenance, no smell to contaminate food, no possibilities of short deliveries because gas is received through a government-tested meter.

An economic service

No other fuel offers such a complete economic service. The question of the oil storage tank and its location is determined largely by the requirements of the local authorities and the possibility of corrosion and leakage in a few years militate against the adoption of domestic oil central heating. The fact that a more regular maintenance is required is also a disadvantage.

Thus, it would appear in the ultimate that, pre-supposing the mass market for boilers is in the 20/30,000 B.t.u. range, gas offers a cheaper capital and running cost in the first five years than does oil, and offers competitive subsequent running costs.

The increase during the first five years in cost over solid fuel boilers is relatively small when related to the many advantages offered by the automatic control available on even the smallest gas installation. Indeed, the subsequent running costs, when the installation has been paid for, are so little above solid fuel, that the premium paid for household cleanliness and convenience is a very small one.

Crystal gazing

Finally one must, to some extent, crystal gaze as to the future of the various fuels. Oil output is at present governed by the balance in its refineries, namely that crude oil is processed to produce a variety of fractions of which domestic fuel oil is only one and this balance in the refinery is flexible only within narrow limits.

Producing larger quantities of fuel oil to be disposed of at a price equal to or slightly less than the cost of crude oil, can be very disturbing if simultaneously an excess of motor fuel is produced.

The National Coal Board seems to be making little progress towards substantial production of a smokeless coal fuel apart from the hard coke from their coke ovens. In comparison, the gas industry, having freed itself from an entire dependence upon one expensive grade of carbonising coal (and recent events show how important this is for there is another coal price increase) so that it can now use more or less any fraction of oil from the oil refinery, tail gas from the refinery, imported methane if necessary and, in

COMPARATIVE FUEL COSTS, CAPITAL COSTS AND SYSTEM CAPACITIES FOR TYPICAL HOUSES USING SMALL BORE SYSTEM

Type of House	Boiler capacity & hot water cylinder capacity	Fuel	Piping & radiators + pump	Builders	Boiler	Controls	Fuel storage	Total costs	Running costs per annum (A)	Comparative annual cost over 5 years: Service + 1/5th capital cost (B)	Comparative annual cost over 5 years: Total annual cost (A & B)	Subsequent fuel + service costs
			£	£	£	£	£	£	£	£	£	£
Two bedroomed semi-detached 725 sq. ft.	30,000 25 gall. cylinder	Coke	160+35	20	50	25	10	300	30–44	60	90–104	30–44
		Anth.	160+35	20	100	25	10	350	28–38	70	98–108	28–38
		Oil	160+35	20	130	15	25	385	39–41	81	120–122	44–46
		Gas	160+35	20	60	15	Nil	290	39–54	61	100–115	42–57
Three bedroomed detached 1,200 sq. ft. floor area	45,000 35 gall.	Coke	240+35	25	60	25	15	400	45–66	80	125–146	45–66
		Anth.	240+35	25	130	25	15	470	43–57	94	137–151	43–57
		Oil	240+35	25	150	15	25	490	59–62	103	162–165	64–67
		Gas	240+35	25	80	15	Nil	395	58–82	81	139–163	61–85
Three bedroomed detached bungalow	45,000 35 gall.	Coke Anth. Oil Gas					As	above				
Larger three bedroomed detached house 1,600 sq. ft.	60,000 50 gall.	Coke	320+35	25	70	25	15	490	60–88	98	158–186	60–88
		Anth.	320+35	25	160	25	15	580	57–76	116	173–192	57–76
		Oil	320+35	25	200	15	60	655	58–62	140	198–202	68–72
		Gas	320+35	25	85	15	Nil	480	78–109	100	178–209	82–113
Four bedroomed detached house 2,200 sq. ft.	90,000 60 gall.	Coke	480+35	30	85	25	20	675	90–132	134	224–266	90–132
		Anth.	480+35	30	185	25	20	775	86–114	154	240–268	86–114
		Oil	480+35	30	230	15	60	850	88–94	180	268–274	98–104
		Gas	480+35	30	105	15	Nil	665	117–164	136	253–300	121–168
Five bedroomed detached house 3,500 sq. ft.	135,000 80 gall.	Coke	720+45	30	110	25	20	950	135–198	190	325–388	135–198
		Anth.	720+45	30	225	25	20	1065	130–172	212	342–384	130–172
		Oil	720+45	30	255	15	60	1125	132–141	234	366–375	142–151
		Gas	720+45	30	140	15	Nil	950	176–246	194	370–440	180–250

In addition to the above the total cost of the hot water system applicable to all fuels is :—
(1) £55 (2) £85 (3) £85 (4) £125 (5) £150 (6) £175.

addition, can produce gas from low quality coals which the National Coal Board seems adequately able to produce in large quantities and for which the price must be considerably lower than carbonising coal, means that the gas industry alone among the fuel industries, has flexibility of manufacturing materials and can buy raw materials in the most economic markets.

There is, therefore, every reason to believe that during the next five years the cost of gas to the consumer will come down—in fact, this was forecast in a comprehensive survey of the gas industry by The Economist in 1958, when it said:—'The chances (for gas) are real and invigorating; as real as, say, economic nuclear power, no more remote, and eventually capable of providing energy a good deal cheaper.'

Oil for gas grid

No doubt these figures published by the Institution of Heating and Ventilating Engineers will provide the necessary incentive to the salesmen in the gas industry to deliver a knock-out blow to their great private enterprise competitors, namely oil, in the mass semi-central heating market.

In a few years domestic oil will be sold to the gas industry, converted into gas and sold through the gas grid to be consumed by domestic gas appliances and the incongruous sight of a huge oil tank waggon or a filthy coal cart in a narrow suburban residential area street will, like the 90% inefficient steam locomotive, be only of historic interest.

Yes, Mrs. 1970 having been sold central heating, will undoubtedly prefer gas as her fuel! For 'only gas gives perfect central heating'—perfect in service, perfect in initial cost, perfect in delivery and for the mass market, even now, perfect in capital and running costs.

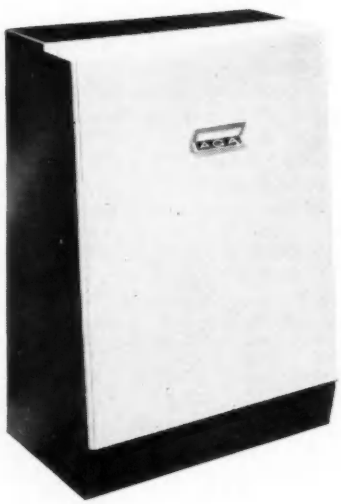
● **FOOTNOTE:** The basis for the I.V.E. costing is: Coke £7-£10 5s. per ton (May, 1960)*, anthracite £10 10s.-£14 per ton (May, 1960), kerosene 17½d.-18½d. per gal. (May, 1960), fuel oil 15½d.-16½d. per gal. (May, 1960), gas 12½d.-17½d. per therm (May, 1960). (The I.V.E. make it clear that the standing charge compensates for the higher price that would be charged for purposes other than central heating without having two meters.)

Calorific values: Coke 12,500 × 2,240 B.t.u. per ton, anthracite 14,000 × 2,240 B.t.u. per ton, kerosene 159,000 B.t.u. per gal., fuel oil 165,000 B.t.u. per gal., gas 100,000 B.t.u. per therm.

Thermal efficiencies: Coke boilers 50%, anthracite boilers 70%, kerosene boilers 70% (vaporising), oil boilers 80% (atomising), gas boilers 80%.

No allowance is made for the load factor (turning down or off at night) which means an improved relative performance for oil or gas for, by clock control, they can be virtually turned off completely and there is only a limited turn down ratio for solid fuel boilers.

* Since May, 1960, increased prices for solid fuel have been announced.



Is the 30,000 B.t.u. gas boiler to be 'the best seller'? Our illustration shows the Aga G. 30(30,000 B.t.u. per hour) manufactured by Allied Ironfounders Ltd. Other Boilers in the range are:—G 45(45,000 B.t.u. per hour), G 70(70,000 B.t.u. per hour), G 99(99,000 B.t.u. per hour), G 150(150,000 B.t.u. per hour).

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COAL SCIENCE LECTURE

Dr. F. J. Dent reviews the hydrogenation of coal

THE ninth Coal Science Lecture arranged by the British Coal Utilisation Research Association was given by Dr. F. J. Dent, O.B.E., Director of Research at the Gas Council's Midlands Research Station. He spoke on 'The Hydrogenation of Coal to Methane.'

Dr. Dent's lecture reviewed the overall position and outlined the gas industry's researches aimed at solving the technical problems facing it in producing a sufficiently rich gas without resort to enriching processes based on oil.

In the most advanced process at present available for completely gasifying coal to make town gas—the Lurgi process—only about half the methane needed is produced, and enrichment with petroleum products is necessary.

Gasification of coal in the Lurgi process is carried out at a pressure of 20-30 atmospheres and uses a mixture of oxygen and steam as the gasifying agent; it results in the production of much more methane than if the process were operated at atmospheric pressure.

One basic discovery by Dr. Dent in the early 30's was that the high methane content of Lurgi gas arises from reaction between hydrogen and the coal substance in the fuel bed.

Dr. Dent outlined the laboratory investigations into the hydrogenation reaction. The investigations had shown that there are two distinct phases in the attack of hydrogen on the coal substance, the first occurring during the rise in temperature from 500°C. when the coal molecules are unstable and yield volatile material; and the second occurring when a final steady temperature is attained, the coke residue then assuming some stability.

Under optimum conditions of temperature and pressure, at least 85% of the coal substance can be hydrogenated to give a methane yield of 500 therms or more per ton of coal.

Pilot scale experiments had been conducted, using a fixed fuel bed, the heat released during the reaction being adequate to sustain it; in the laboratory experiments, however, external heating had been necessary. The effectiveness of the heat of the hydrogenation reaction as a means for rapid carbonisation of the fuel was also demonstrated; but if the temperature autonomously attained reached too high a figure, the methane yield was found to suffer.

Experiments with fluidised beds allowed more rigid temperature control and led to the proposal that the process should be operated at 25-50 atmospheres pressure in two stages. In the first, operating at 800-850°C., the 'volatiles' would be hydrogenated and in the second, 900-950°C., the carbon residue.

Two proposals for making gas with a calorific value of 600 B.t.u/cu.ft. using hydrogenation reactions were described; both had overall thermal efficiencies in the region of 75%.

In the first all the coal would be hydrogenated, the 'char' being used to produce (a) from water gas the hydrogenating gas, as well as (b) the steam requirement.

In the second, run-of-mine fuel would be used, the 'large' fuel being gasified in a slagging fixed bed gasifier to produce the gas for hydrogenating the 'fines'; the residue from hydrogenation would be used for steam raising.

Dr. Dent concluded by admitting that formidable chemical engineering problems have to be overcome, but held the view that successful incorporation of hydrogenation into a process to produce gas solely from coal should be possible.

A dinner was held later at Savoy Hotel, London, at which the Coal Science Medal was presented to Dr. Dent.

CUTLERS THE NAME WITH A GREAT REPUTATION

IN THE GAS INDUSTRY, BASED ON 120 YEARS' EXPERIENCE IN THE MANUFACTURE AND ERECTION OF ALL TYPES OF GASWORKS PLANT

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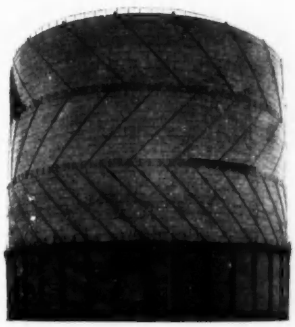

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ST. ALBANS MOVES INTO PREMIUM FUELS FIELD

THE chairmen of 32 public health committees of local authorities, mostly with their chief public health inspectors, and the general managers of the development corporations of three new towns were present at the inauguration last week of the Eastern Gas Board's new carbonising plant at the St. Albans works.

They saw Sir Henry Jones, the Chairman of the Gas Council, unveil a plaque on the retort house which has a potential output of 1,500 tons of Cleanglow a week.

Speaking at a lunch held later at Watford Town Hall, the Chairman of the Board, Mr. J. H. Dyde, said that in the past coke had sometimes been a dirty word, 'but I can tell you that it is now a greatly reformed character.'

Gas boards had been giving very much greater attention to the production of improved smokeless solid fuels for the domestic market and were now able to make a very substantial and definite contribution to the implementation of the Clean Air Act.

Early gas ignition

As far back as 1928 the South Metropolitan Gas Company had developed an open fire with gas ignition specially designed for burning coke, and there were now over one million homes using coke for space heating.

Mr. Dyde described the virtues of Gloco and Gleanglow, both of which names were used by courtesy of the North Thames Gas Board. Of Cleanglow he said: 'We spent a whole year in experimenting with a large number of coals before selecting those used today at St. Albans, and the Coal Board has undertaken to maintain supplies. As further coals are found and made available to us it will be possible for us to extend this principle to other plants as and when there is an additional demand for this type of fuel.'

Mr. Dyde emphasised that the tonnage of Cleanglow likely to be available was a relatively small percentage of their total production of solid smokeless fuels, and Gloco was in much freer supply.

NEWS SUPPLEMENT

It was their intention to make Cleanglow, Gloco and boiler nuts available in 28-lb. prepacked units not only through coal merchants but through any other dealers who cared to take up the business, such as hardware stores and garage proprietors.

'Garages, of course, are open at weekends, and what is easier when you have not sufficient fuel in the house than to put a couple of bags of Cleanglow in the back of your car?'

Congratulating the Board on their very progressive marketing policy, Sir Henry Jones said: 'What we have seen today represents the latest developments whereby the gas industry can give a first-class heat by gas and solid fuel all made from coal.'

Among those present were Mr. Michael Milne-Watson, Chairman of the North Thames Gas Board; Mr. Ernest West, Chairman of West's Gas Improvement Co. Ltd. the main contractors; Mr. Brian Holmes, Chairman of W. C. Holmes & Co. Ltd., who were responsible for the gas purification plant; Mr. Robert Neil, the architect of the scheme; Mr. H. Gibbin, Manager of the Solid Smokeless Fuels Federation; Mr. W. H. Bourne, the Manager of London and Counties Coke Distributors' Association; and representatives from the Ministry of Power, the Coal Board and the British Transport Commission. The plant was fully described in last week's issue of the 'GAS JOURNAL.'

Above: *Mr. J. H. Dyde, Chairman of the Eastern Gas Board, thanks Sir Henry Jones, Chairman of the Gas Council, who has just inaugurated the new carbonising plant at St. Albans.* **Below:** *Photographed outside the retort house are Mr. E. C. Woodall, Mr. F. B. Holmes, Mr. Michael Milne-Watson, Mr. Lawrence West, Mr. George Calder, Sir Henry Jones, Mr. F. T. Brookes, Mr. J. H. Dyde, Mr. A. S. Moody, Mr. E. O. Rose, Mr. T. C. Battersby, Mr. H. Wadsworth, and Mr. L. F. Garner.*

First of its type in Britain

GUERNSEY'S NEW SIMON-CARVES OTTO CATALYTIC REFORMATION PLANT OPENS

THE first of its type in the British Isles, a 2½ mill. cu.ft. per day Simon-Carves Otto catalytic reformation plant was officially opened at the works of the Guernsey Gas Light Co. Ltd., Bouet, Guernsey, last week, by the island's lieutenant-governor, Vice-Admiral Sir Geoffrey Robson. Representatives of British, Irish, Danish and West German firms attended.

The Chairman of the Guernsey Gas Light Co. Ltd., Advocate J. E. L. Martel, introduced the lieutenant-governor.

He said gas had been produced from coal for the past 130 years. With the introduction of the Simon-Carves plant a step in evolution of the gasworks had been taken, for this worked entirely on oil.

The break which had been made with the coal merchants was deeply regretted, but economic reasons had been decisive and they had decided to go over to butane, Advocate Martel said.

The new plant was entirely automatic and for people living in proximity to the gasworks it would mean that at last they would be free of the nuisance of dirt and grit.

Attracted engineers

The new plant had attracted engineers from England and they were always delighted to see them.

Advocate Martel welcomed Sir Patrick Hamilton, a Director of Simon-Carves, and Lady Hamilton.

Vice-Admiral Sir Geoffrey Robson said the new plant showed that the people of Guernsey were once again living up to their reputation for long-sightedness and good judgment. They were keeping well ahead of the requirements of the island without going into any ill-considered scheme.

The new plant would have a capacity of a million cubic feet a day more than the old one.

Sir Geoffrey said he had asked if there was not some danger in the new plant, which produced gas almost sulphur-free, that escapes would go undetected. He had been assured that an odorant had been added and that it could be detected if a leak developed in the supply.

One-man supervision

He said what amazed him particularly was that only one man was needed to supervise the plant. With the old plant 30 men had been needed. He pointed out that men were still needed for maintenance of the new equipment.

'I was particularly glad to hear,' he said, 'that in installing this plant local labour had been used to the maximum extent. In fact, I understand Simon-Carves employed only about 30 people from outside the island.'

He then cut a white ribbon which stretched from the platform to the top of the plant.

After the opening, guests were shown round the plant.

There was a luncheon at the Royal Hotel, St. Peter Port.

A milestone

In a speech afterwards, Advocate Martel said that the opening of the new plant was a milestone in the history of the Guernsey Gas Light Company.

He said gas had been used in Guernsey since 1830.

In April 1850 a company was formed with capital of £10,000 divided among 155 subscribers. The price of gas at that time was 10s. per 1,000 cu.ft. The business succeeded and later this price was reduced to 7s. per 1,000 cu.ft.

In present day terms the price of gas in 1850 was equivalent to 0.78d. In 1939 it fell to 0.39d. and today it had risen by only 1d. a unit, despite the tremendous rises since the war in the cost of labour and materials. In 1870 there were 1,200 consumers. Now there were 13,400 consumers.

Cost of coal

Advocate Martel said: 'The price of coal has recently gone up by 10s. a ton. This would have meant an increase in our coal bill of £9,000 per annum.'

Mr. S. G. Vane, the company's Managing Director, and Mr. J. E. Morris, Manager, visited a number of plants on the Continent and as a result began to explore the possibility of making gas from oil. At the same time they came in contact with Tholstrup of Kosangas, Denmark.

Advocate Martel said: 'The board decided to install plant which would produce gas from butane which we would obtain from Kosangas, Denmark, on advantageous terms.'

The next question was to decide on the most suitable type of plant. Various types were considered, and after a great deal of thought they decided on the Otto catalytic reformation plant.

The work of installation was entrusted to Simon-Carves Ltd., of Stockport. The butane comes by direct pipe from St. Sampson's harbour to the company's bulk storage plant at Bulwer Avenue.

The gas produced by the plant had similar characteristics to that produced by the old carbonisation plant, Advocate Martel said. In fact, it was superior in that it had practically no sulphur content. The plant was automatic and needed only one operator to supervise and adjust the output according to demand.

'You will no doubt have been impressed by the smallness and cleanliness of the plant as compared with the old plant,' he said. 'As you will appreciate, we have been able to reduce very considerably our labour force. I am glad to say that all men who became redundant have been absorbed in other industries.'

Long notice

Long notice was given to the men who had to be dismissed and the company had been complimented by the unions on the way the matter had been handled.

On behalf of the guests, Sir Patrick Hamilton thanked the company for a most interesting day, and for the hospitality extended to them. He congratulated the company on the decision to install a 'pocket-size' plant to replace the old one. It had been a privilege to be associated with the work.

He said there was no doubt that the wind of change was running through the technical background of our times. Today they had seen a new look in gas plants and he hoped it would be copied in other places. It was clean, modern, and there was no smell about it.

Gas leak danger

Referring to the dangers of gas leaks going unnoticed, of which the lieutenant-governor had spoken, Sir Patrick said that his own company was involved in trying to remove the carbon monoxide content from gas.

If this could be done there would no longer be any need to have a distinguishing smell in gas.

He said the plant represented chemical engineering of a high order. The size of the plant spoke for itself.

Among those who attended the opening and the lunch which followed it were: Mr. A. G. Henriksen and Mr. T. Nielsen, Danish Gas Association; Mr. L. and Mr. H. Tholstrup, Kosangas, Denmark; Mr. J. Tholstrup, Kosangas, Ireland; Mr. G. Barritt, Managing Director, Simon-Carves; Mr. W. R. Garrett, Construction and Consultant Engineer, Northern Gas Board; Dr. A. E. Haffner, Chief Engineer, Southern Gas Board; Mr. D. C. Elgin, Technical Officer, Scottish Gas Board; Mr. F. Asgill, Vice-Chairman, Stephenson Clarke, Ltd.; Dr. A. J. Payne, Simon-Carves; Mr. E. Thomas, Bratt Colbran Co. Ltd.; Mr. C. A. F. Bennett, Sales Manager, Bratt Colbran Co. Ltd.; Mr. F. C. Bedloe, Drake's, Halifax; Mr. F. Hooper, Director, Radiation Group Sales; Mr. H. Stuart-Walker, Radiation Group Sales; Miss S. Ashworth, demonstrator, Radiation Group Sales; Mr. C. W. Duret-Aubin, Chairman, Jersey Gas Light Co. Ltd.; Mr. W. Wedgwood, Engineer, Jersey Gas Light Co. Ltd.; Mr. E. Shaw, Mobiloil Ltd.; Mr. E. Halfyard, Simon-Carves.

CORRESPONDENCE

Dear Sir,

As a retired senior gas officer, a former member of the Senior Gas Officers' Joint Council, and former Chairman of the South Eastern Branch of the Gas Officers' Guild, I was pleased to learn of the increases in the salaries of gas staffs and of the more recent increases to senior gas officers agreed by the Senior Gas Officers' Joint Council to operate from October 1, these amounting to about 12½% of the maximum salary in each group, the increase in the case of an officer in the highest group, i.e., Group I, being £350.

The Officers' side of the Senior Gas Officers' Joint Council have consistently maintained that the salaries of senior gas officers were low in relation to those paid generally in industry, and it is now obvious and pleasing to know that something has been done partially to correct this position without any references to increases in the cost of living. In my opinion this was long overdue.

PAY AND PENSIONS

It is interesting to note that in the case of a senior officer on the maximum step of Group I, the cost of living increases which he had received up to November, 1958, amount to £505 which is approximately 22% on the assumed salary he received at vesting date. The latest increase in salary of £350 brings the total increase to £855 (salary £3,155), or approximately 37.2% of the vesting date salary. An officer working in the London district gained, in addition, on July 1, 1958, £60 per annum London Weighting, making the total increase £915 (salary £3,215), equal to 39.8% on the vesting date salary.

This is all to the good, but I must now make the point that an officer, for example, who retired in 1958, before the cost of living award of £80 awarded in November of that year, and the London Weighting allowance of £60, had an increase on the vesting date salary of £425, or 18.5%. Assuming such an officer worked in London, was entitled on retirement to two-thirds of his salary, then his pension in 1958 would be about £326 less than it could be if he retired now.

Many officers who have retired in recent years had to carry heavy responsibilities and work in connection with the process of getting the nationalised industry 'going,' and they have been manifestly underpaid for their services. I hold the view therefore that the Gas Council should give consideration to the relatively unfavourable position in which they are now placed, and I hope that the Council will take steps to secure an increase in their pensions.

I would make it clear that I am writing this letter in a private capacity, although as one affected.

Lt.-Col. J. A. GOULD, M.C., M.I.MECH.E., M.INST.GAS E., F.R.S.A.,
Retired Distributing Engineer, South Eastern Gas Board.

100, Woodland Way,
West Wickham,
Kent.
October 8, 1960.

PERSONAL NOTES

MRS. L. W. ROBERTS has been elected Chairman of the Women's Gas Federation. Mrs. Roberts, who belongs to the Harrogate branch, has been a member of the Executive Committee since 1954, and represents the Federation on the North East Regional Committee of the Women's Advisory Council on Solid Fuel. She succeeds as chairman Mrs. Gwen Evershed who has held the position for the past three years.

MR. W. H. PARRY has been elected President of the Purchasing Officers Association. Mr. Parry played a leading part in forming the Bedfordshire and Herts. Branch of the Association, and was later chairman of the Midlands Branch. He is a member of the Association's General Purposes and Finance Committee and the Development Committee.

MR. EDWIN BAYLISS, Chairman of the North Thames Gas Consultative Council, has been appointed a Commander of the Most Venerable Order of the Hospital of St. John of Jerusalem. MR. JOHN UNDERHILL has been awarded the Board's Medal for gallantry and resolution when an explosion occurred in the booster house of the Richmond Holder Station on July 24.

MR. F. R. NORRIS has been appointed Manager, Research and Development, of Perl Controls Ltd., and MR. N. B. HARRIS has been appointed Manager of the Technical Department. Mr. Norris has been engaged in development work with the firm for the past four years. Mr. Harris has been at the Watson House industrial, commercial and domestic laboratories for 21 years.

PROFESSOR B. BLEANEY, and DR. JAMES COOK, have been appointed members of the Council for Scientific and Industrial Research by the Minister for Science. Together with a third member yet to be appointed, they succeed PROFESSOR P. M. S. BLACKETT, SIR ERIC ASHBY, and MR. H. DOUGLASS, who have retired on completion of their period of service.

MR. E. G. SMITH, deputy general manager of the Glasgow and Western Division of the Scottish Gas Board, is now Production Manager and Grid Controller.

HON. TREASURER F. R. BLACKLAWS of Perth and BAILIE W. DALRYMPLE of Buckhaven, Fife, have been appointed members of the Scottish Gas Consultative Council, by the Minister of Power.

OBITUARY

The EARL OF VERULAM has died at the age of 50. A peer who chose to enter industry, Lord Verulam was deeply interested in questions of public welfare, and performed valuable work in the five years before the outbreak of the second world war with the Subsistence Production Society of the Eastern Valleys of Monmouthshire, a social experiment in combating the situation in South Wales resulting from the depression. In 1949, Lord Verulam became a part-time member of the North Thames Gas Board. He was also chairman of the British Institute of Management and the Institute of Industrial Administration.

COMING EVENTS

October 25.—WALES AND MONMOUTHSHIRE JUNIORS, SOUTH WALES SECTION: Newport. Address by R. J. Gregg on 'Publicity and Advertising.'

October 27.—I.G.E., MIDLAND SECTION: Visit to John Wright & Co. Ltd. (Radiation Ltd.), Essex Works, Aston, Birmingham. 10.30 a.m.

October 28.—I.G.E., MANCHESTER AND DISTRICT SECTION: Ordinary general meeting and paper by L. W. Andrew.

October 29. — EAST OF SCOTLAND JUNIORS: Paper by E. Shiell on 'The Wiggins Gas Holder,' followed by a paper on 'Distribution in the Border District,' by R. Forrest.

November 1.—THE INSTITUTION OF PLANT ENGINEERS, PETERBOROUGH BRANCH: White Lion Hotel, Church Street. 'The Development of Smokeless Fuels,' by J. Owen. 7.30 p.m.

November 1.—THE INSTITUTION OF CIVIL ENGINEERS: Great George Street, Westminster, S.W.1. Presidential Address by Sir Herbert Manzoni.

November 1.—THE INSTITUTION OF CHEMICAL ENGINEERS, NORTH WESTERN BRANCH: Blossoms Hotel, Chester. 'Prediction of Ternary Data from Binary Systems,' by E. Evans. 7.30 p.m.

November 1-3.—INSTITUTE OF WELDING: Autumn Meeting.

November 2.—THE COMBUSTION ENGINEERING ASSOCIATION: The Gloucester Hotel, 102, Union Street, Aberdeen. 'The Automatic Boiler House.' 10 a.m.

November 2.—WALES AND MONMOUTHSHIRE JUNIORS, SOUTH WALES SECTION: Port Talbot. Paper by J. A. W. Stretton on 'The Development of Industrial Gas Sales in North Wales.'